Finally…This is where the rubber meets the road. Here goes.

There are six major components comprising the Video Van system. They are:

- Power supply equipment
- Video camera•
- Computer hardware
- Distance Measuring Instrument (DMI)
- GPS equipment / GPS software
- Video computer software

DM¼ What?

GPS¼ What's that?

DMI - Distance **M**easuring **I**nstrument. A glorified electronic odometer that measures distances traveled relatively accurately. The DMI is part of the video van configuration, as it is the "triggering" device for the software system.

GPS stands for **G**lobal **P**ositioning **S**ystem. The system allows you to locate yourself anyplace on earth through the use of satellites. Accuracy is directly proportional to the amount of money available for equipment. For an excellent introduction to the ins-and-outs of GPS; a visit to Trimble,s homepage at http://www.trimble.com is highly recommended. This technology optional to the operation of an imaging system, and will discuss in more depth as this manual continues.

Unfortunately GPS equipment doesn't come cheap and your entry into digitizing, codifying and coordinating your corner of the world should be well planned prior to acquiring the hardware. Don't despair if you can't afford the GPS equipment just yet. The good news is that this imaging software is milepost-based and GPS equipment is not needed to make the basic imaging system work. However, GPS data can be readily incorporated with the images in a database and used in lieu of, or in conjunction with mileposting to reference and call up the images.

Hardware

The following procedures will describe the assembly of a video van. See **Appendix A** for a list of vendors and a list of equipment (manufacturer and model numbers also provided).

Although the entire installation process could be done professionally, it is recommended that at least some of the installation be done internally. There are two reasons for this. First, it is cost effective to perform the initial installation in-house.

Secondly, familiarity with the system configuration will enhance troubleshooting and problem correction capabilities.

On the other hand, if you usually wind up with extra parts after fixing the family car you may want to consider having the van professionally assembled it for you.

Regardless of your "tinkering prowess," it is recommended that the charging and inverter system, DMI and camera pan/tilt be professionally installed. These components are difficult to connect without the proper tools. Consequently their installation is omitted from these instructions. Likewise, the installation of the roof mounted rotating amber warning lights is not discussed since installation of this safety device is well within the competence of any maintenance shop. The same goes for custom work spaces and seat placement.

> ***Note:*** Please read the following instructions before proceeding with any of the installation work. It is recommended that all wiring, along with the location of all equipment, be documented as a part of the installation process. Throwing in a videotape to supplement your van conversion documentation is an excellent way of recording your efforts. Obviously good documentation is invaluable when it comes to future repairs, modifications, or equipment replacement.

"Power Plant"

First, it is necessary to install a heavy-duty alternator (130 Amp) and a extra battery to power the equipment is strongly recommended. Don't skimp here, this is one area where "heavier" is definitely better than "lighter." The alternator in WSDOT's video van was installed at the dealership, however this can be done at your own maintenance facility or a van conversion shop.

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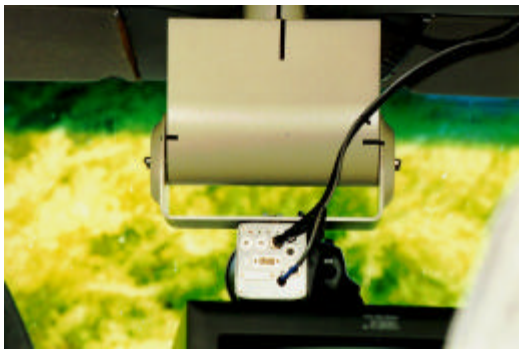
Outside Help

The DMI should be installed next (Tacoma speedometer installed the one in WSDOT's van.) The camera pan/tilt and the workstation can then be installed by a van conversion shop (Pro Line installed the pan/tilt in WSDOT's Video Van). The camera pan/tilt should be installed in the center of the ceiling, just behind the windshield (the rearview mirror will need to be removed) leaving enough room for the movement of the camera and zoom lens once they are attached. If you chose to go with a GPS system, keep in mind that the antenna should be mounted above the camera and this would be a good time to install it while the head liner is down for the pan and tilt installation. There is more information on GPS antenna placement discussed in the chapter on GPS equipment.

The pan/tilt apparatus is not the only way of mounting the camera. Other methods may prove to be just as good and less expensive. For years WSDOT's old video van did just fine with the camera mounted to a metal post that was attached to the floor and ceiling of the van. A little experimentation may save a few nickels.



Side and Back Views of Video Camera With Pan

Workstation

It is important to design the workstation with consideration for operator needs as well as the security of the equipment. It also makes a lot of sense to concentrate as much of the equipment into one area or 'stack' as possible. This makes wiring the components together a lot easier. Since these issues are primarily a matter of personal preference (and space limitation), the workstation and cabinetry installation will not be addressed except to say "measure twice and cut once."

Driver and Operator Configuration

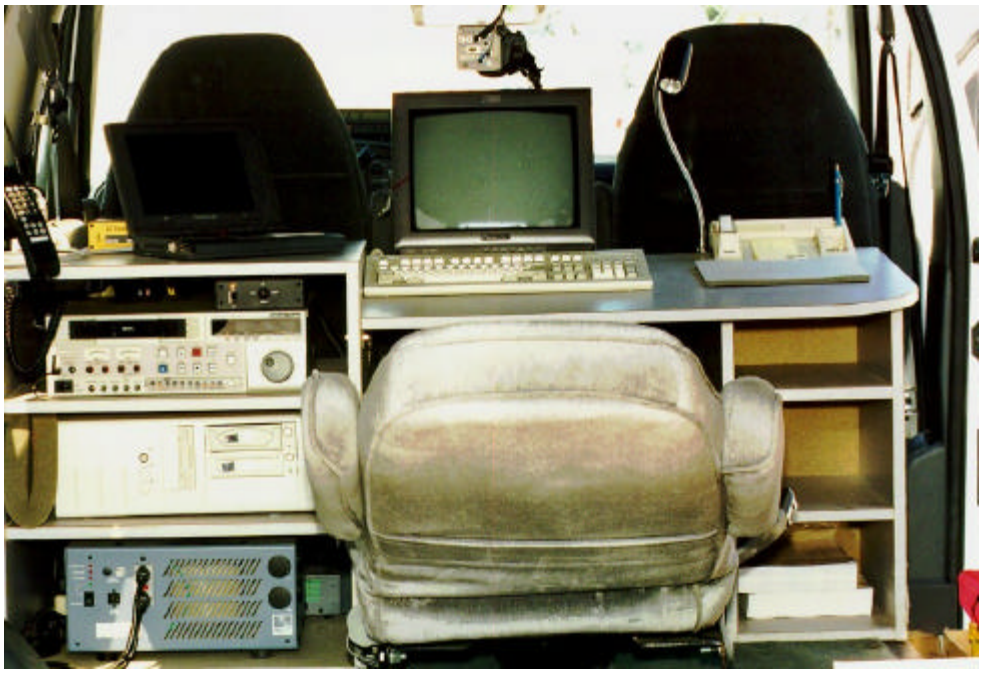
Velcro¼ the "Duct Tape of the Sophisticated"

Velcro is an ingenious fastener that attaches, detaches and reattaches easily, it works great for holding smaller pieces of equipment, such as the dashboard mounted DMI, in place. Velcro has all the advantages of duct tape but none of its drawbacks. Ever try to unwrap something held together with duct tape? Messy, isn't it?

Velcro in Action

DMI Mounted for Easy Viewing by Driver

When everything is said and done the inside of your van should look something like the picture below.



Here is How it Looks Installed

See **Figure 1** for a schematic representation of all major system components that make up the video van.

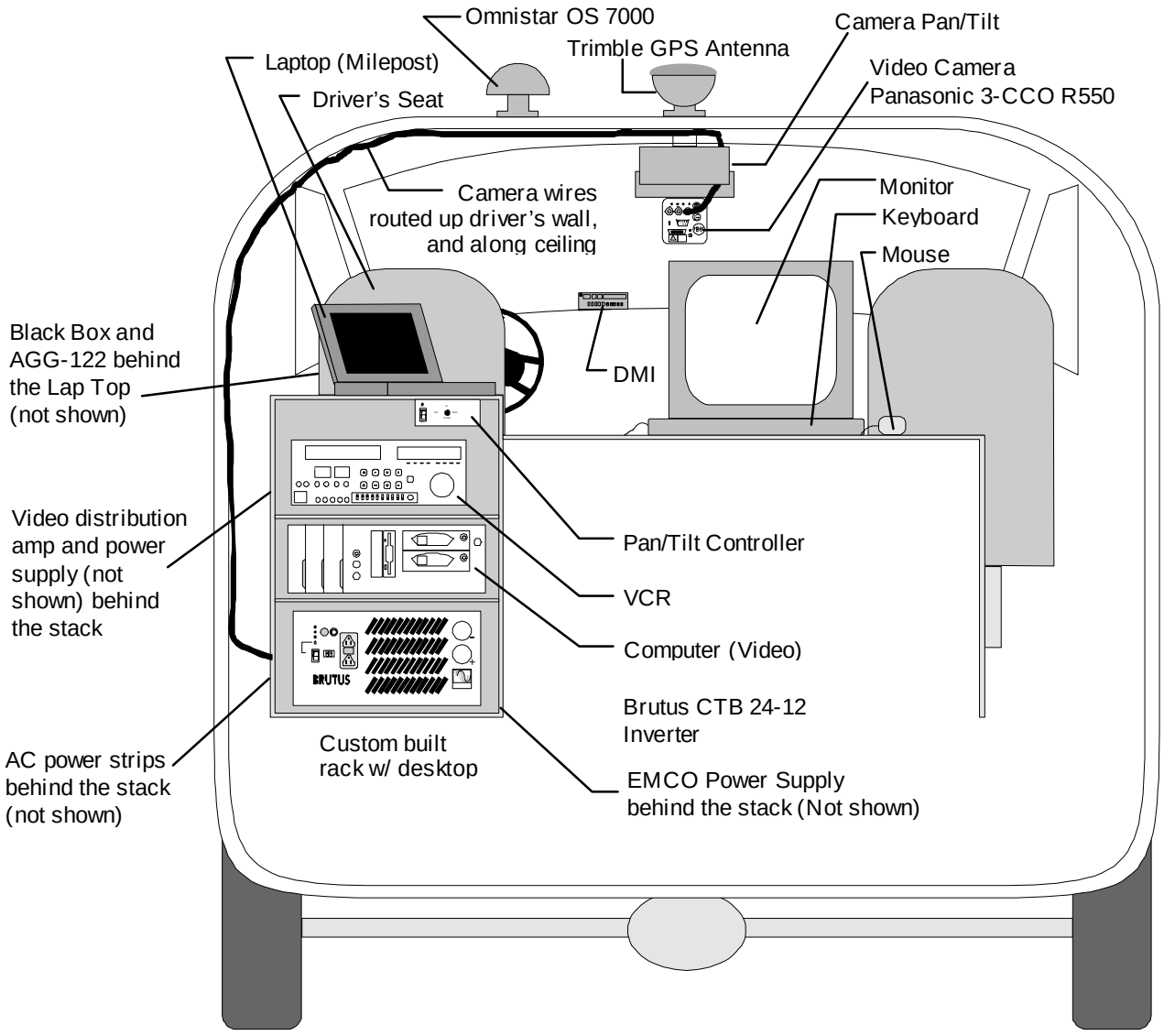


Figure 1
Video Van Workstation Layout Diagram

Inverters

> Inverters are oddball electronic devices that don't really invert anything. They simply change a DC voltage from your vehicles battery to an AC voltage to run your equipment.

Important!

The inverters listed in **Appendix A** are designed to be safe near computer equipment. This is definitely good news. A mistake here could be a real show stopper. For obvious reasons this issue should be addressed prior to actually purchasing the unit. Whatever inverter you chose make sure that it is "frequency controlled" and rated for computer usage.

It may also be necessary to experiment with the placement and wiring of the equipment before committing to a particular design. While experimenting, check over the parts list and decide on specific equipment needs, cord lengths, etc. Avoid locating equipment near fans or motors, also in hot or damp areas as well. The stack of equipment in the Video Van is located behind the driver's seat under the left hand side of the desktop. The video distribution amplifier and Emco power supply are located on the back side of the "stack." Consequently these items have been noted, but not shown in Figure 1, however they are relatively small and can be easily positioned. With most of the equipment located in one area, space is conserved and the wiring is simplified.

Procedures

First, mount the video camera (with zoom lens and iris cable affixed) on the pan/tilt bracket, then install the capture and overlay boards in the video computer (Pentium - 150 minimum). The boards will come with installation instructions (yeah, right).

> Flatter your resident computer guru into installing the boards for you. It may cost you lunch and a little groveling but its well worth it.
>
> *Trade Secret*: Keeping a bag of your guru's favorite treats on hand may help in case of emergencies, and may also improve on going working relations.

<u>If you are useing optional GPS equipment</u>, attach the Trimble antenna mounted directly above the camera, on the roof of the van. If this equipment is going to remain in a portable state for use in other configurations, you may want to purchase a permanent mounting bracket for this installation and magnetic mounts for more portable usage.

<u>If you are using a rebroadcast DGPS correction signal,</u> Attach the Omnistar to its power/output cable and mount it toward the rear, centered, on the roof of the van using a permanent or magnetic base. It is recommended to mount these antennae at least 5 feet apart and 5 feet away from all other antennae. The cables for these two

units can be routed in through a window if you are wanting to keep this equipment portable, but a permanent mounting system is recommend.

GPS Antenna
This picture shows antenna installation on magnetic mount with cables run through the side window. This is a temporary installation.

The microphone is used for adding audio on the videotape. Signage and other features can be difficult to see on the videotape, so the driver would read all signs to help identify the information on them, forming an audio record. The foot switch is used to activate the microphone.

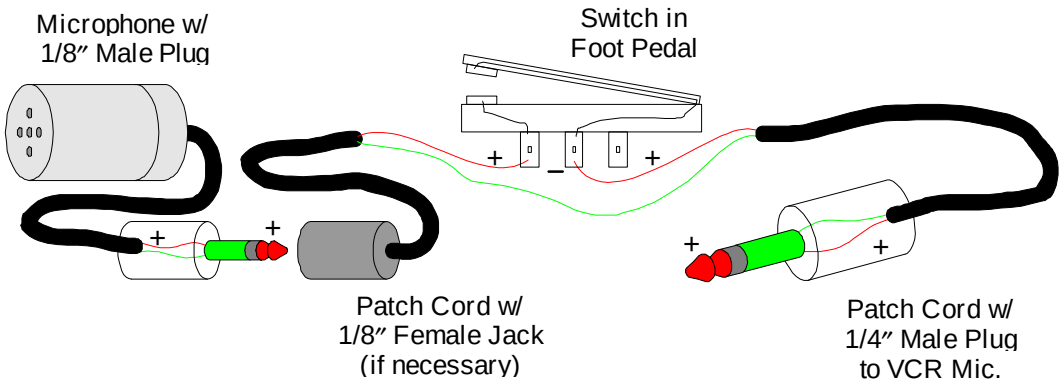


Figure 2
Microphone Wiring

Set the foot pedal, for activating the microphone, on the driver's side floorboard where the driver will have the easiest access to it (left foot operation) and place the rest of the equipment in its location (including power strips). The microphone should be clipped on the windshield visor. Drivers window should remain closed during operation to avoid excess wind noise.

Wiring

1. Mount the microphone on the driver's visor, routing the cable to the foot pedal. The cord will more than likely reach the pedal, but not the VCR microphone jack. A patch cord is necessary to reach from the VCR, to the foot pedal. (Refer to **Figure 2** for steps 1-5.)
2. Open the housing of the LINEMASTER foot pedal, noting the switch contacts. Test the contacts to be sure which ones will leave the circuit open (not allowing current to flow), until the switch is activated (closing the circuit and allowing current to flow).
3. First each conductor, should be labeled to keep track of matching polarities. Start by cutting the plug end off of the microphone cord at the foot pedal, leaving just enough wire attached to the microphone to reach inside the pedal. If the cord doesn't reach the foot pedal, then use a patch cord between the microphone and the foot pedal. The positive wire will initially be connected to the end pin on the male plug, while the negative will be connected to the case. The conductors should be labeled prior to cutting to keep track of matching polarities.
4. Now route the male ¼-inch mono type patch cord from the VCR's microphone jack to the foot pedal. Cut the patch cord at the foot pedal leaving enough wire to reach between the microphone, and the appropriate contact in the foot pedal. Again, the positive wire will be initially connected to the end pin on the male plug.
5. Solder the microphone's positive wire (or the patch cord's, if applicable) to one side of the switch. Next solder the positive wire of the VCR's patch cord to the other side of the switch. Then solder the two remaining negative wires together and shrink wrap the connection. Test the microphone at this point. Once the microphone is turned on, it should not function until the foot pedal is depressed.

Steps 6 - 13 Describe the installation procedures for installing a Trimble AGG - 122 and Omnistar Rebroadcast DGPS system. This system was tested by WSDOT, but was unable to provide high enough accuracy for determining LRS (Linear Referencing System) mileposting. The problem was the time sync between the computer and the GPS unit. The reason it is left in this version of the manual is because, it was found to be accurate enough to allow your images to be tied to a line feature on a base map in GIS. The Latitude and longitude was good, this is a nice feature for digital images, the only negative was no tie to a milepost (LRS). If your not currently using a LRS, but you want to tie your images to your GIS, this is a low cost solution that may work well for a local agency. In future chapters on GPS we will discuss the use of a more portable system using Trimble PRO XR's (or whatever the latest and greatest is at the time), and how to establish a LRS with dynamic segmentation. Until those chapters are written this will have to do, as with equipment purchase you will need to do some home work before purchasing.

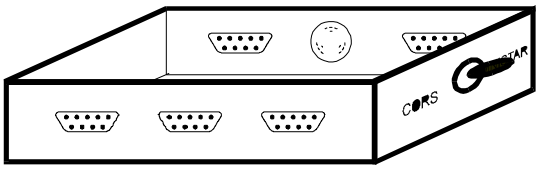


Figure 3
Black Box Layout

> ***Note:*** The project box (Black Box) is available at your local electronic supply store, i.e., Radio Shack.

6. Cut holes in the project box for mounting the switches and 9 pin bulkhead connectors (see **Figures 3 and 4**). Mount the switches and bulkhead connectors. Using hex standoffs on the outside of the box with short screws on the inside to fasten the bulkhead connectors which will allow the cables, eventually connected, to be fastened to the box using thumbscrews.

> ***Note:*** When building the black box from scratch, it would be easier to use a male connector for the RTCM port to eliminate the need for a connection adapter.

7. Wire the switches and connectors in the project box as shown in **Figure 4**.
8. Route and attach the Trimble's antenna cable to the AGG-122 receiver (see **Figure 5**).

FIGURE 4
BLACK BOX DIAGRAM

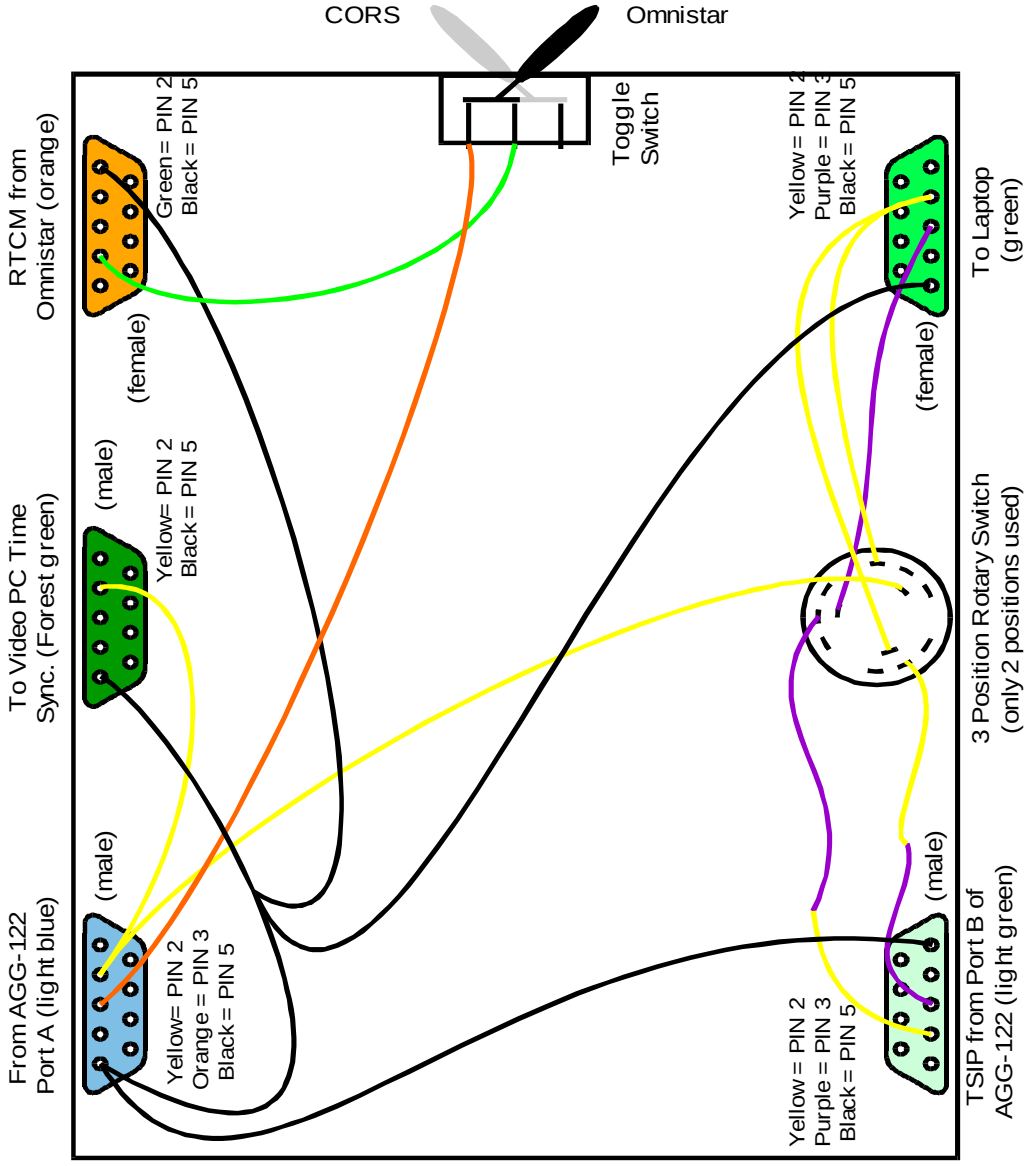


Figure 4
Black Box Diagram

9. Cut the DC plug off of the Xenotronix battery charger, then wire the negative side of this cord to the negative power supply wire on the power/data line for the AGG-122 and wire the positive conductors of the same cords together with an in-line fuse in between (see **Figure 5**).

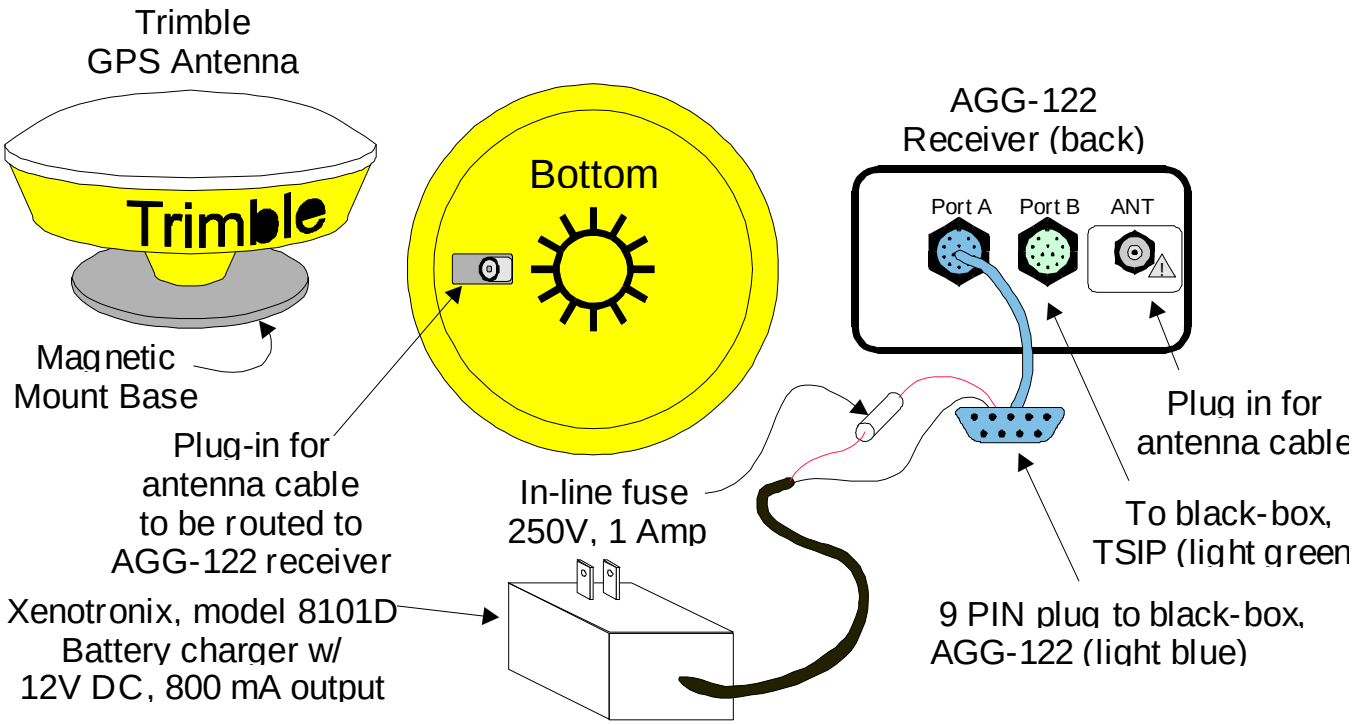


Figure 5
Trimble Antenna and Agg-122 Receiver

10. Attach the power/data cable for the AGG-122 to PORT A of the AGG-122 and connect the 9 PIN plug to the AGG-122 port on the black-box (see **Figures 4 and 5** [light blue]). The power portion wired to the Xenotronix battery charger can be plugged into one of the power strips later. Then attach the AGG-122 data cable to PORT B on the AGG-122 and connect the 9 PIN plug of the cable to the TSIP port on the black-box (see **Figures 4 and 5** [light green]).

Note about **TSIP: T**rimble **S**tandard **I**nterface **P**rotocol, is used to configure the AGG-122 program and port settings, see appendix d, for these setting.

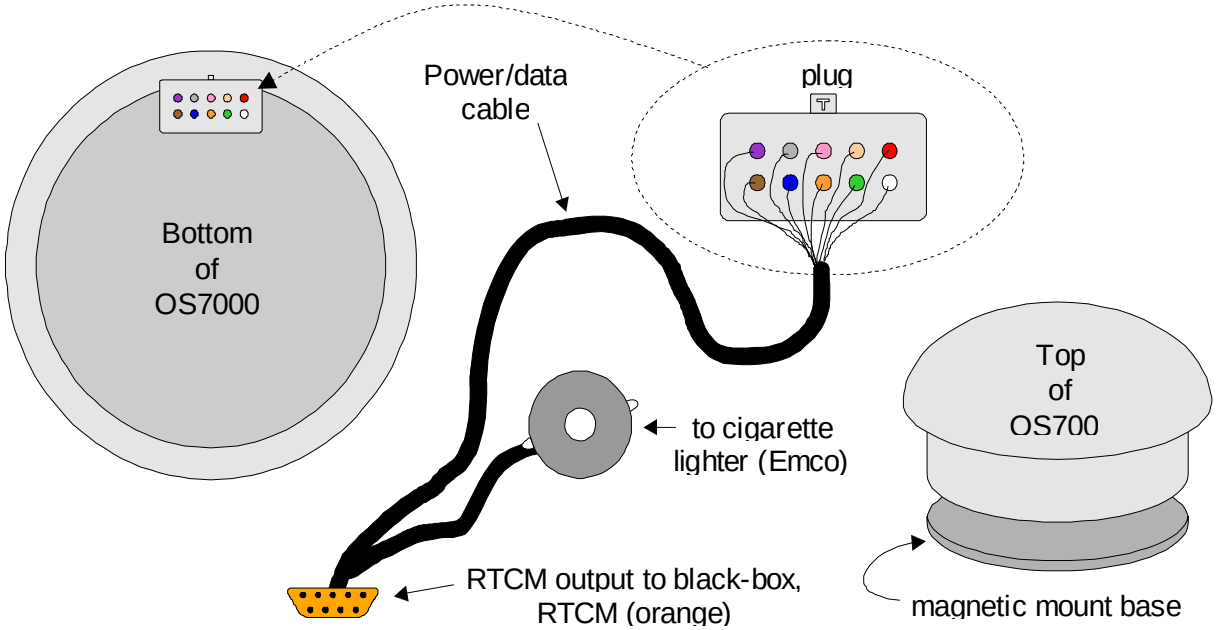


Figure 6
Omnistar OS700

11. Route and attach the 9 PIN plug of the Omnistar's power/output cable to the RTCM port on the black-box using a male-male adapter (see **Figures 4 and 6** [orange]).
12. Attach an RS-232 serial cable to the serial (9 PIN) port on the back of the **laptop then connect the other end to the laptop port on the black-box (see Figures 4 and 7** [green]).
13. Attach the 25 PIN to 9 PIN adapter to the 25 PIN serial port on the back of the video PC and plug in an RS-232 (standardize) serial cable (see **Figure 8** [forest green]).
14. Attach the other end of the RS-232 serial cable to the PC Time Sync. port on the black-box (see **Figure 4** [forest green]).

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15. Attach the "9 PIN to 4 PIN modular" adapter to the standardize serial port on the back of the video PC and plug one end of the phone line into the other side of the adapter (see **Figure 8** [dark blue]).
16. Plug the other end of the phone line into the DMI data port (see Figure 9 [dark blue]).

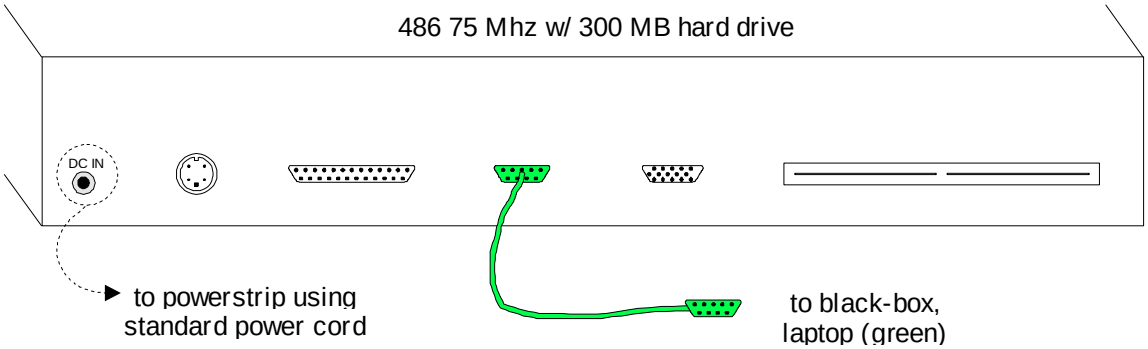

Figure 7
Laptop (GPS) Computer Back Panel

17. Attach one of the cords supplied with the Magni Desktop CG overlay board to the upper SVHS jack of that board on the video log computer (see **Figure 8** [red]). Then attach the RCA end of the 15-foot "male RCA to male BNC" patch cord to the cord on the overlay board. Also, make sure that the switch on the top of that board is in the **up** (composite) position.

18. Route the 15-foot RCA to BNC patch cord up the wall, behind the driver's seat, and along the ceiling to the camera (see **Figure 1**).

19. Attach the BNC end of the RCA to BNC patch cord to the VIDEO OUT jack of the video camera, (see **Figure 10** [red]).

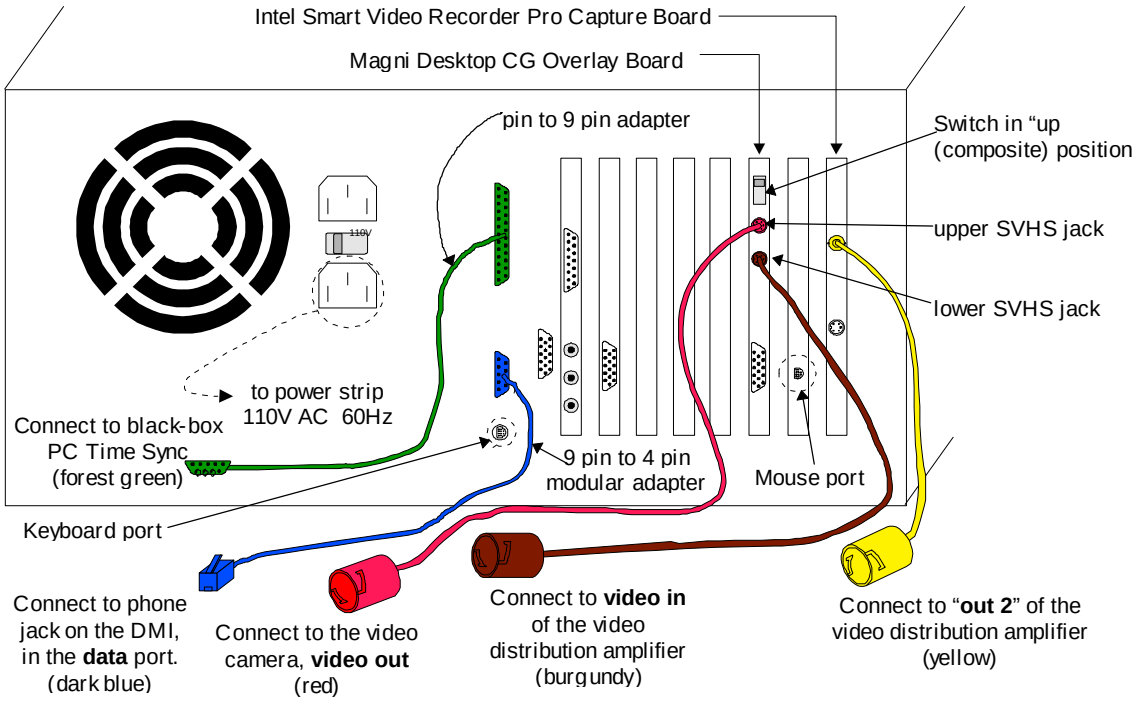

Figure 8
Videolog Computer Back Panel

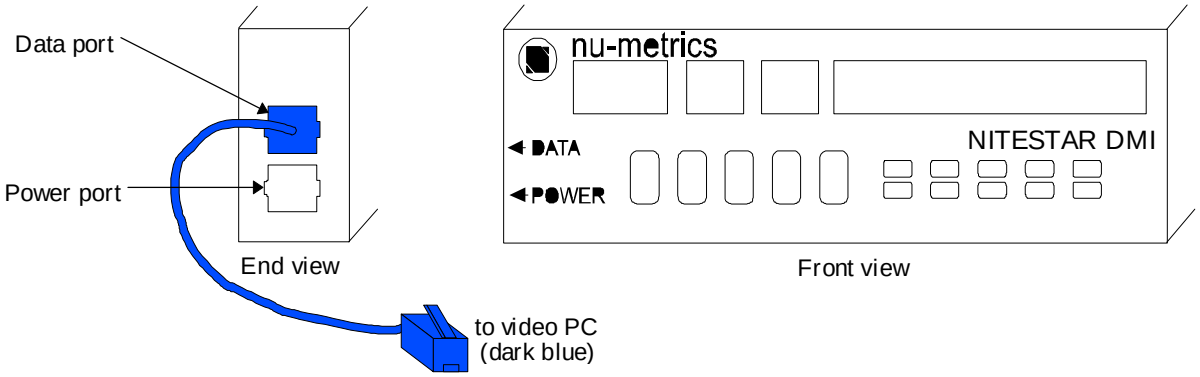

Figure 9
DMI

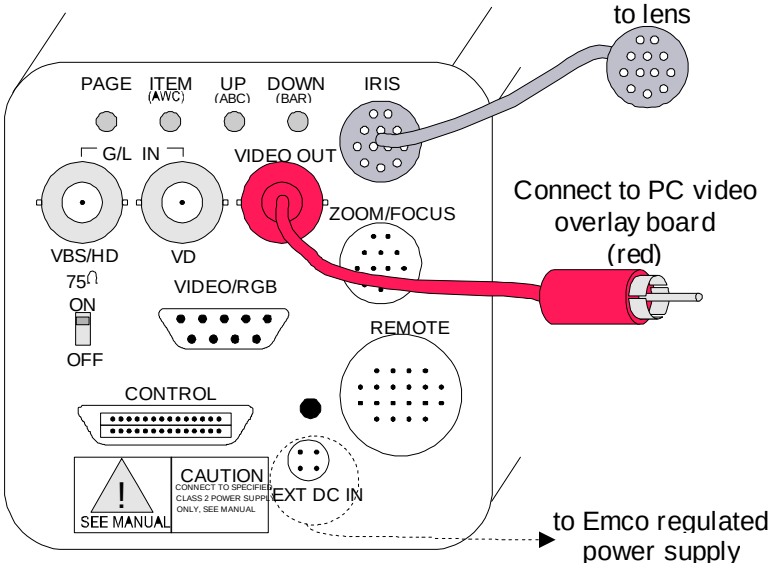

Figure 10
Video Camera (Back)
Panasonic 3-CCD E550

20. Connect the other cord supplied with the Magni Desktop CG overlay board to the lower SVHS jack of that board on the videolog computer (see **Figure 8** [burgundy]) and attach the RCA end of the short male RCA to male BNC patch cord to it.

21. Route, then attach the BNC end of the patch cord to the VIDEO IN jack of the video distribution amplifier, (see **Figure 11** [burgundy]).

22. Connect a BNC patch cord to the BNC jack of the capture board on the back of the video computer (see **Figure 8** [yellow]).

23. Now attach the other end of the BNC patch cord to the video distribution amplifier, OUT 2 jack (see **Figure 11** yellow]).

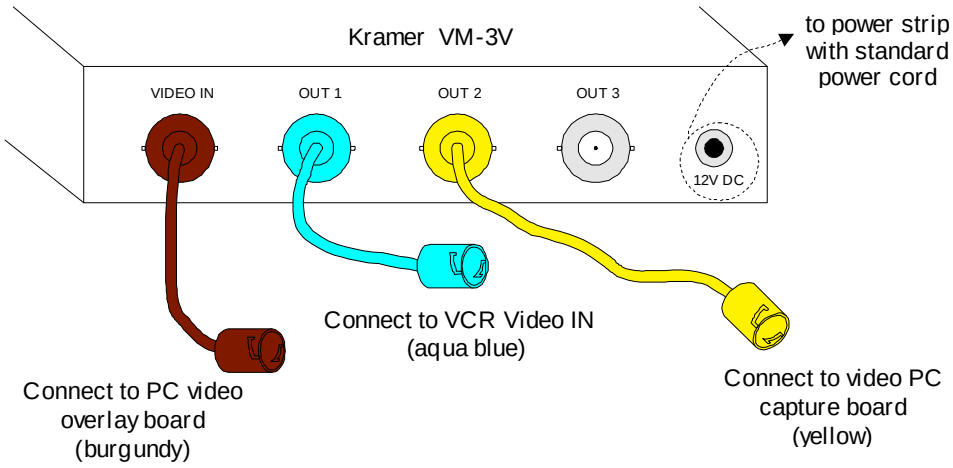

Figure 11
Video Distribution Amplifier

24. Attach a BNC patch cord to the video distribution amplifier, OUT 1 jack (see **Figure 11** [aqua blue]).

25. Now connect the other end of the BNC patch cord to the VIDEO IN jack, on the back of the VCR (see **Figure 12** [aqua blue]).

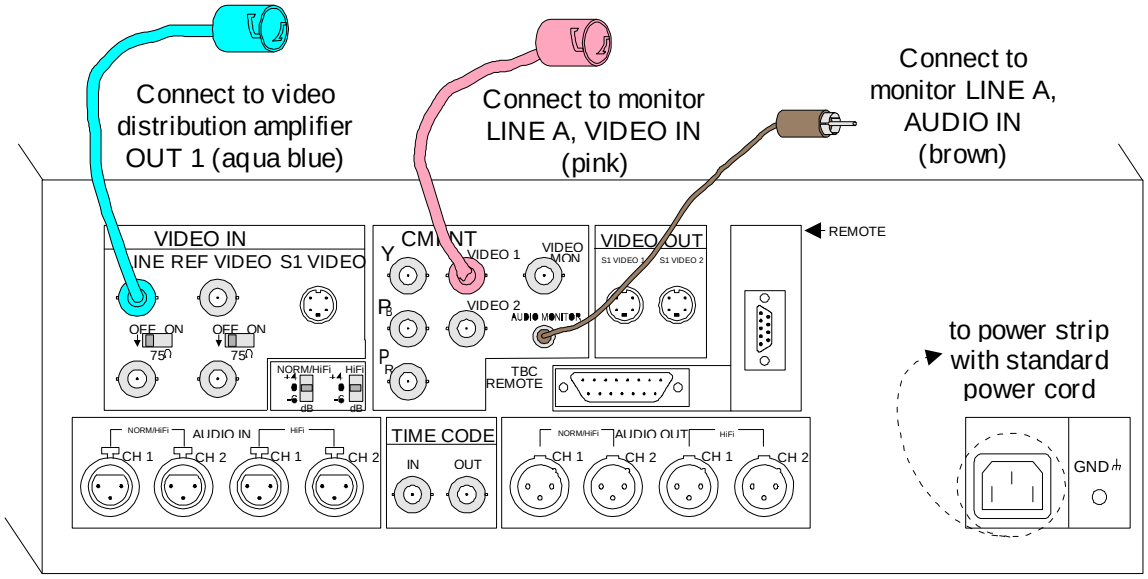

Figure 12
SVHS VCR (Back)
Panasonic AG-DS850P

26. Connect one end of the RCA patch cord to the CMPNT, AUDIO MONITOR jack on the back of the VCR (see **Figure 12** [brown]).

27. Now connect the other end of the RCA patch cord to the LINE A, AUDIO IN jack on the back of the monitor (see **Figure 13** [brown]).

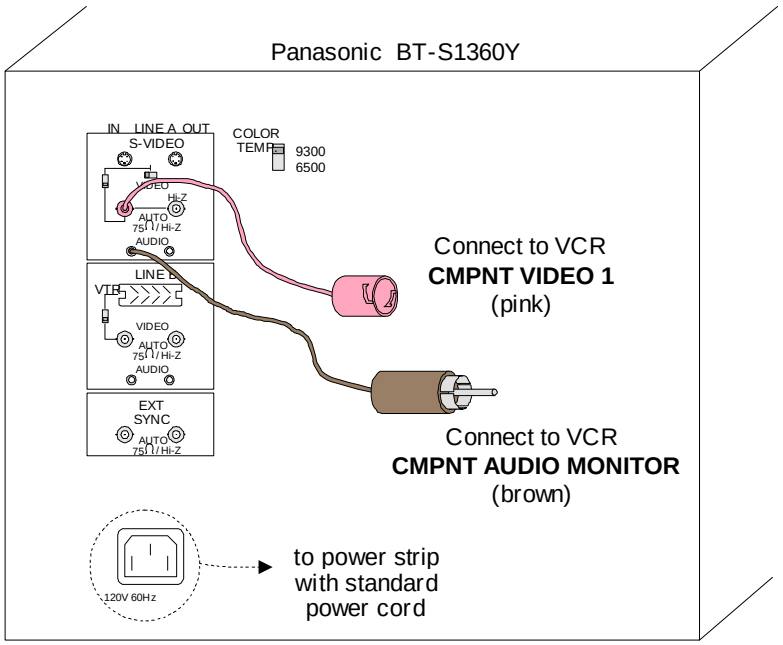

Figure 13
Monitor

28. Attach a BNC patch cord to the LINE A, VIDEO IN jack on the back of the monitor (see **Figure 13** [pink]).
29. Now connect the other end of the BNC patch cord to the CMPNT, VIDEO 1 jack, on the back of the VCR (see **Figure 12** [pink]).
30. Arrange the AC power strips between the driver's seat and the workstation (behind the 'stack') so that the power cords for all of the equipment can reach and can be plugged into the Brutus CTB 24-12 Inverter (see **Figure 14**). One of the power strips (this one should be used for as few devices as possible) needs to be plugged into one of the other power strips.

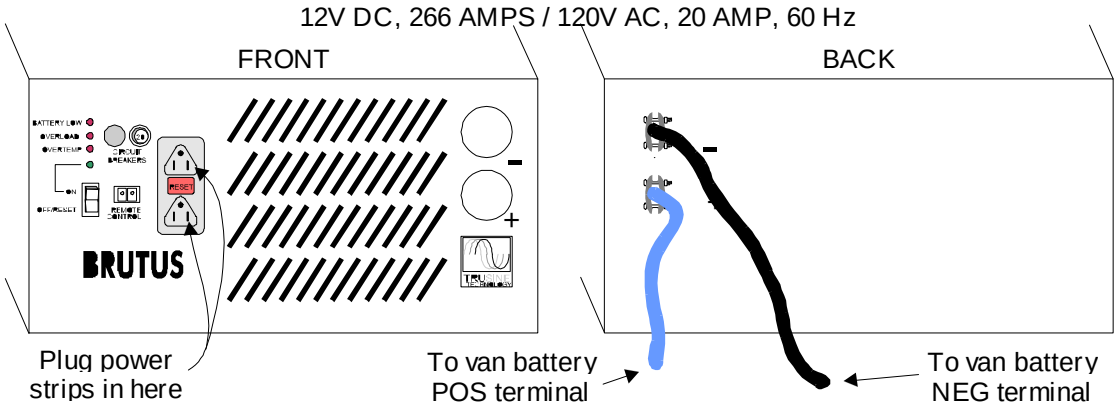

Figure 14
Brutus CTB 24-12 Inverter

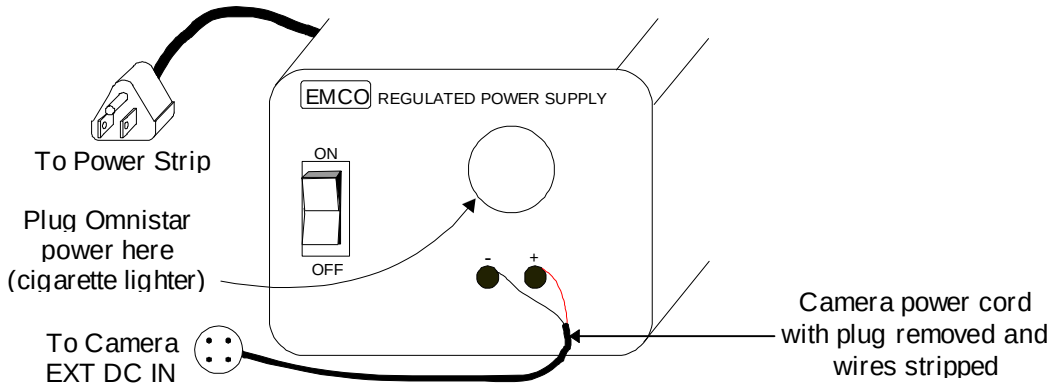

Figure 15
Emco Power Supply

31. Install the EMCO power supply behind the stack as well and plug it into one of the AC power strips.
32. Attach the power cord to the video camera (see **Figure 10**).
33. The plug on the loose end of the camera's power cord needs to be cut, then strip enough of the two wires to attach to the Emco power supply (see **Figure 15**).
34. Attach the VCR power cord to the VCR and plug it into one of the AC power strips.

Attach the video monitor power cord to the video monitor and plug it into one of the AC power strips.

35. Attach the video distribution amplifier power cord to the video distribution amplifier and plug it into one of the AC power strips.
36. Attach the videolog computer power cord to the videolog computer and plug it into one of the AC power strips.
37. Attach the laptop PC to its power cord the and plug it into one of the AC power strips.

Video Van System Flowchart